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PROPOSAL
for the
Alberta Water Plan

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THE PRAIRIE RIVERS IMPROVEMENT AND MANAGEMENT EVALUATION
PROGRAMME
(P.R.I.M.E. PROGRAMME)

Submitted to
The Hon. H.E. Strom
Minister
Dept. of Agriculture

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R.E. Bailey
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INTRODUCTION

There is today throughout the world, a growing awareness at all levels of society of the vital importance of our water resources and the need for sound, intelligent development and management of these resources to ensure the continued development and future economic stability of our country. Here in Canada, and particularly in Alberta because of our geographical location in relation to other provinces, this awareness is emphasized by the conditions we observe in our neighboring country of the Unites States where the water situation has been labeled as a national crisis.

Although it would be an exaggeration to suggest that a water crisis exists in Canada, and even more so to suggest that such prevails in Alberta, it behooves us to observe the course of events that have taken place in other countries, and when we do this in the light of present day economic and population growth of our own province, we cannot help but conclude that early constructive planning and positive action is most wise if we are to avoid a crisis resulting from inactivity until the situation becomes one of 'too little too late'.

We are wise also if we observe and study the methodology employed by countries which have for many years embarked on a resource development programme. We have the advantage of being able to view the overall picture both in detail, and with regard to general results. We have the opportunity to discern what has been good and what has been bad as suggested by the historical events of resource development programmes elsewhere.

The need and justification for resource development, particularly that pertaining to water, can be found in a multitude of writings, publications, and a historical review of events from the beginning of civilization. It is not the intent of this presentation to expound further

on the subject. Rather, it is assumed that the need for the development of our own water resources has been accepted as vital. It is assumed that the government of the Province of Alberta is fully cognizant of the desirability, and indeed the essentiality, of embarking on the planning and implementation of a progressive water resource programme. It is assumed that the government is prepared to consider proposals for such a programme.

It is the object of this presentation therefore to submit such a proposal, indicating ways and means whereby a plan may be evolved and implemented.

To anyone who has devoted time, thought and research, to this subject there becomes evident an essential basic principal which must provide the foundation for the evolution of any large scale water resource development proposal. This principal is simply the fact that 'the development and utilization of water resources cannot be isolated from the development and utilization of other resources'. Water is the agent of interaction between all resource development. Water is the medium upon which, to one degree or another, all development is dependent. Because of this, there can arise many conflicts of interest in the demands imposed by the multitude of water uses. It is useless to build dams exclusively for the conservation of water for which there is no demand or means of utilization. It would be inexcusably foolish to construct water development projects that are not in harmony with the potential development of other resources of the area both natural and human. Conversely, endeavours to exploit other resources, or to foster urban and agricultural development in areas that are inadequate in opportunity for compatible development of water resources would be equally ineffective.

It is immediately obvious that co-ordination of resource development agencies is imperative. The nature and degree of forest

management will have a direct influence on the quantity and quality of water which any particular forested watershed will contribute. The development of new lands for agricultural purposes without adequate consideration of water supply and drainage problems will prohibit utilization of the maximum capability of the land. The contribution to water pollution by the establishment of industry must be fully explored. The ever growing impact on the economy of the country from recreational activity must be given its proper consideration. This is to mention only a few of the aspects of inter-play between water and the social and economic growth of any country.

Undoubtedly those involved in the administration, development and utilization of our provinces' natural and human resources are fully aware of these considerations. They are mentioned here only to establish one of the basic concepts on which the proposal herein is formulated.

However, these considerations also immediately dictate a second principal which obviously follows without any stretch of logical imagination. This is the imperative need for co-ordinated and co-operative activity on the part of all public and private resource development agencies in the evolution of a common objective, the compilation of an overall plan, and the implementation of this plan in a manner that will mesh all gears together so that the project machinery will hum along smoothly, ensuring that the job is competently and expertly accomplished.

Based on these two concepts, the following proposal has been prepared. It is one which is general in nature, not dealing with the complexity of detail beyond the scope of one individual to enumerate, in the belief that great strides are made by taking one carefully considered step at a time. The acceptance of the proposal in principle will open the door to more intensified consideration of the details involved.

THE PLAN

The Development Unit

Because of the intimate relationship between water and all other social and economic development, and because any water resource utilization programme must have established boundaries within which the programme is to be conducted, it is proposed that the watershed basin be adopted as the development unit. This is in keeping with the procedure established in any country in the world that has embarked upon large scale water programmes. The watershed basin defines the principle boundaries within which the characteristics of the watershed can be established as a common denominator.

In Alberta there are two principal drainage basins. The one flows northward into the Artic Ocean, and the other flows generally northeast to the Hudson Bay. These in turn may be divided into some ten major basins, which in turn can be subdivided into any number of smaller basins, the size and nature of which are sufficiently versatile to satisfy the desire of any resource development planner.

As previously outlined to the Alberta Cabinet, the distribution of our provinces' water in relation to the population and water use demand distribution, immediately establishes a general course which a water plan should follow. As water utilization in the southern areas of the province are developed to the maximum without satisfying demands, additional supplies can be introduced from more northern regions of greater water abundance and lesser demand. As stated, this is a general course, since it will not always be physically feasible to make diversions to serve all areas in which excessive demands may arise. Efforts must be made therefore to fully utilize the available resources for use within that area

rather than to transport water to some other downstream location which could feasibly be served from other sources. These considerations will be particularly applicable to the supply of inter-provincial waters. Without recognition of this possibility, the planner may have to resort to excessively refined and more costly sophisticated means of increasing water yields in the upper reaches of watershed areas. Such refinements as chemically enhancing infiltration rates of headwater basin soils, or the intricate management of snow-packs, or the control of forest harvest in a manner that is not compatible with the timber industry, should be avoided, or at least delayed until the economy of the development so far progressed can support and justify such refined application of modern technology.

Further, in making diversion from northern watershed areas, these should be in harmony with the potential of that area in order that water supplies are not depleted in a 'rob Peter to pay Paul' fashion.

These and many other aspects of all resource development within a defined watershed area will have to be considered based on the individual characteristics of the watershed, its geography, its economic and social structure, and its position in relation to other contiguous basins each having its own distinctive characteristics and circumstances. However, the useful development of the water resources as a common denominator to which all other development may be related in some degree, will provide a basic usable tool in fostering the growth of development of the basin as a whole.

The Development Programme

It is proposed that the programme set as its objective the optimum development and management of all the resources of the development unit. The word optimum is used in preference to maximum, because optimum implies

a degree of development which is most suited to the economic circumstances of any particular time. The degree of development which will define the optimum will vary with time and place in relation to other economic and social factors which prevail. To achieve optimum development in some areas of the province today may require that absolutely nothing is done to change existing conditions, however, in five or ten years from now, the social and economic structure may have altered to the point where projects should be undertaken to support or enhance the new economic trend.

It is evident therefore that any watershed management and development programme must be flexible to bend with and accommodate the trend of the period. It must not however, be a passive programme which follows rather than leads. It should be a programme that will provide sustinance without which other natural and human resource progress may at best struggle unsuccessfully for survival.

The programme should also recognize that watershed management and development work hand in hand. There is nothing that man does to the land which does not manage the watershed in one way or another, either for evil or for good, for its detriment or its enhancement. Man has been morally obligated and committed to watershed management ever since God told Adam to dress the garden and to keep it. Management has already begun when the first tree is planted or uprooted, and when the first fence is constructed or torn down.

Many have attempted to reach an understanding as to what is meant by total watershed development and management, but the subject is so broad as to defy definition. However, it might be suggested that the water resources aspect of 'watershed management' can be said to be'the art and science of managing the land, vegetation, and water resources of a drainage basin for the development, use, control, and protection of the watershed for the benefit of man'.

To quote from a recent paper by Almo W. Huffman, hydrology specialist for the State of California, 'total watershed development and management implies a successful forging of the complicated chain of events which began long before the development becomes a reality. First there must be careful and thoughtful planning based on realistic evaluation of human needs. These plans must be based on the results of much patient and wise research, carefully guided to produce a large body of knowledge about a host of complex relationships carried on within a framework of practicality and common sense. This planning must receive the approval stamp of engineering practicality, economic justification and financial feasibility.

In addition to these requirements, the plans must have social acceptability. This involves a high level of presentation of the engineering facts to convince public agencies that the proposed development is not only needed, but has a favorable probability of success, and to assure private owners that the work proposed for their property is beneficial to them. The plan should be presented to the private sector in such a way that landowners will come to the sponsors and ask to be included in the development.'

Before embarking on development programmes, we must first know something of the nature of the clay from which we are to prepare the mold. A complete inventory is therefore indicated of all physical, economic and social characteristics of the development unit. In the more densely populated areas of the province, this information is already at hand and it is necessary only to collect and consolidate it for analysis. In other less settled regions an existing inventory programme can be utilized or new and additional ones initiated as considered necessary.

From the Water Resources point of view, the following inventory data would be collected.

1. Precipitation
2. Run-off
3. Groundwater
4. Problems of water deficiency.
5. Problems of floods.
6. Problems of water quality.
7. Problems of drainage.
8. Potential storage.
9. Utilization of storage.

Other resource departments would logically obtain a similar inventory specifically related to its particular resource, and the accumulation of all data will provide the basis on which to compile total watershed management and development plans.

The water resources aspect of these plans would require the study of such subjects as are listed below.

1. Capture and control of water.
2. Conveyance to areas of need.
3. Re-regulation in areas of use.
4. Development of use for water.
5. Flood control.
6. Recreation.
7. Power generation.
8. Water quality.
9. Drainage.

These considerations would have to be closely correlated with those of other resources of the area in order to arrive at an optimum beneficial return to the existing and potential social and economic structure.

One timely example of an integrated basin approach to resource development would be to consider the South Saskatchewan basin which today contains a respectable area that is under irrigation. An extensive and comprehensive study is currently underway pertaining to all aspects of irrigation development, operation and management, including primary and secondary economic benefits. A policy committee has been established

to digest the results of these studies and hopefully to present to the government a proposal suggesting the nature of future policy regarding the irrigation industry of the province.

In terms of a total basin development concept, irrigation would be considered as an integral part of the overall development, which in fact it is, in terms of its economic and social influence, rather than an isolated entity of its own, independent of other resource utilization within the basin. Such an approach might conceivably provide a means of overcoming some of the difficult problems associated with the establishment of an irrigation policy. It could provide a new outlook for financing through the apportionment of costs to the various benefits derived, directly and indirectly, from the irrigation works including the headwater storage and diversion projects necessary to supply the water. These works have a secondary benefit of providing a certain degree of streamflow control, water conservation, and recreational opportunities. These are benefits which can be related to others of the area besides those who are considered to be the primary beneficiaries from irrigation. Management of resources on a watershed basis would include, among other things, the most efficient and beneficial use of water for irrigation purposes at the farmer level in keeping with water availability within the basin and in accord with our basic policy of water use priority.

Development Co-ordination

An effective resource development programme should be undertaken through the medium of three stages of action.

1. Decision making.
2. Planning.
3. Implementation.

Decisions would be made at the Cabinet level. These decisions would be related to the approval of plans and proposals submitted to the Cabinet by the planning body.

The planning body would compile plans and proposals from information gathered by the various government departments involved. Upon approval being given by Cabinet to any plan, these same government departments would be responsible for implementation of the scheme.

The Cabinet already exists. The individual departments already exist. The planners also exist, but not as one body.

It is proposed therefore that a body be established for the integrated co-ordination of all planning and implementation of resource development. This body should consist of representation from every department that is actively engaged or concerned to any degree with resource development of the watershed basin. These representatives should be selected, not only for their knowledge and ability in their particular profession, but also for their ability to apply imaginative and creative thinking and who recognize, with deep conviction, that total watershed management is vital to the solution of human needs. This body should provide for the pooling of the knowledge and intellect of all disciplines, the participation of which will be essential to the successful optimum resource development and management of the total watershed.

In order to take the greatest advantage of both specialized technical knowledge and administrative competency, but at the same time, because this body should be a participating group, the individual member of which will physically become involved in the work to be done, it is suggested that representation be selected from an administrative level below Deputy Minister.

There is today, a growing co-operative effort between various departments of government towards compatible objectives. The proposed

body for the co-ordination of planning and implementation is merely an expansion of the existing nucleus of this co-operative effort. It would provide however, for representation from all agencies in one body rather than the establishment of unrelated co-ordination of activity by any one department with each of several other departments individually.

Although we are fortunate at the present in the prevalence of department administrators who willingly extend and receive co-operative planning, the success of this arrangement is crucially dependent on the individual, his attitudes and his philosophies. Since this proposal is not one intended to accommodate the needs of today, tomorrow, next year, or even for ten years hence, but rather for an indefinite future period of time, since watershed management and development is ever continuing, the official establishment of a co-ordinating body would ensure the future co-operative inter-departmental participation regardless of individual personalities that may from time to time be involved.

Policy and Programme Guidelines

There are many and varied preparations which are prerequisits to the initiation of total watershed development and management. One such has been mentioned, that of an inventory. Concurrent with this however, consideration must be given to a policy to set the terms and conditions of the programme. Unless such a policy is formulated initially, we eventually might well find ourselves in the same situation on water resource development as prevails today with regard to irrigation. This situation prompted the undertaking of extensive studies in an effort to devise a consistent, equitable and practical irrigation policy, all of which is taking place half a century after irrigation in the province was first undertaken.

One ingredient of a programme policy would be consideration of financing. It is proposed that efforts should be made to devise a formula for the distribution and allocation of project costs in relation to benefits derived, which would be repayable over a specified period of time, say fifty years, so that development of our water resources can be made to pay for itself. Revenues are derived from the harvest of our other natural resources in the province, and although the development of such a formula may be thwart with complexities owing to the unique nature of water, the manner of its occurrence, and the irregularities of its distribution and the written and unwritten riparian rights and privileges associated with it, it is nevertheless suggested that the ultimate success of water resource development will, to a large measure, be dependent on the ability of such development to financially support itself.

Another ingredient of a policy would be consideration of the extent to which local individual participation will play a role in the overall scheme. It is suggested that no development programme can be successful without public acceptance and participation. Individuals, however, are not going to request or even participate in programmes of which they have no knowledge or understanding. There will consequently be a need for concentrated extension work to distribute factual information to the general public in order that the individual will have a fair opportunity to evaluate the benefits of any programme in relation to his own needs and those of the community. In the final analysis, it will be the people who will have the say. Government can provide the opportunity for the individual to better his own environment, and if this opportunity is taken, supply the necessary guidance, assistance, both technical and financial, in order that he may successfully accomplish this end.

Recommendations on such aspects of a policy might logically be formulated by the co-ordinating body or selected sub-committees there of.

ROLE OF THE WATER RESOURCES BRANCH

Present Status

Much of the water resources information necessary to compile plans for a water development programme has already been accumulated for some areas of the province, and is ready for application to a watershed basin oriented type of programme. In other areas more work is yet required, some of which is underway. Plans of the watershed basins are being drawn, on which are super-imposed data as they become available. Some areas have been given only superficial consideration and require detailed study before all factors are known.

In other cases, projects have been studied which are of a specific nature rather than pertaining to general water resources development. These projects are associated with existing problems of flood control, water supplies, drainage and erosion. The obvious immediate need for such projects is sufficient justification for their implementation without embarking on more refined and elaborate studies such as those related to economic benefits. In all cases however, where major works were contemplated for the storage or diversion of water, these are viewed with regard to their relationship to the overall basic water plan concept for the province.

On smaller projects, such as the many drainage schemes that are being constructed in the Peace River area, there is a growing realization that these too must be orientated towards an overall basin plan. Co-ordination of activity between the Water Resources Branch, the Department of Lands and Forests, the Department of Highways and the Northern Alberta Development Council has encouraged this type of planning.

Proposed Action

The growing demand for better water management to solve problems within the province, and the growing inter-provincial and international attention directed toward more complete utilization of water resources, which creates a sense of urgency to implement a water plan, leaves no alternative but to programme for immediate expansion and increased activity to progressively meet responsibilities now and over the future years.

It is proposed that an engineer be engaged and assigned to each major watershed basin on which active and concentrated study is being conducted, together with the necessary supporting technical staff and facilities. It would be required of this engineer to acquire an intimate knowledge of every aspect of the basin. He would be field supervisor of all water resource surveys and investigations and would assist in the planning of the watershed development projects.

To compliment this activity it will be necessary to increase staff of supporting and related divisions of the branch.

It will be necessary to seek out, engage, and be prepared to pay for, the services of specialists with experience in the various component fields of the overall programme.

It will be necessary to engage the services of consulting firms to undertake specific studies and investigations, particularly those related to potential dam sites and storage reservoirs. The use of private consulting firms will avoid the undesirable growth of a complex organization and permit establishment of an organization of administrators and planners to guide and direct the various aspects of the programme.

It is recognized however, that a certain amount of field activity will have to be undertaken by the branch to effectively knit together all aspects of the programme, and to ensure that supervisory capabilities are the result of practical experience as well as technical knowledge. Some

aspects of the programme will be more competently achieved by branch staff than by others found elsewhere in private enterprize, because of the intimate knowledge and experience which branch personnel have had the opportunity to acquire in relation to water resources and the specific needs of the social and economic environment of Alberta. Adequate facilities must be provided to make the best use of this advantage.

Schedule of Action

It is proposed that the next two years be designated as a'tooling up' period during which intensive preparation and some construction be undertaken. Subsequently, expansion should proceed in a manner considered most desirable and expedient with the view of reaching a point of stabilization in about 1972.

Beyond that time it is difficult now to visualize what the nature of things may be. It is hopefully anticipated that a fairly consistent yearly workload programme can be established with minor fluctuations during the years to follow. However, this is unpredictable today since the progress of any water development plan is influenced by so many factors, each equally unpredictable for any great future time.

It is to be hoped that by 1972, the concept of resource development on the basis of watershed basins will have progressed sufficiently that comprehensive plans for some of our major watershed areas will have been completed and future development can be carried out in accordance with these plans.

In the meantime, it is proposed that action be taken within the next two to five years to initiate construction of some of the major projects on which a significant contribution toward the improvement of prairie rivers is self-evident. Such projects would include the following:

Three Rivers Dam - Oldman River

At the request of Alberta, the P.F.R.A. have for some time been investigating possible storage sites on the Oldman River system. Investigations at the Gap site, long thought to be ideal, disclosed certain foundation conditions which prompted the decision to look for an alternative site. Alberta therefore requested that studies be made of what is known as the Three Rivers site located north of the town of Pincher Creek below the junction of the Castle and the Crowsnest Rivers with the Oldman River.

Although these studies are not yet complete, they have progressed sufficiently to virtually assure engineering feasibility. As a stream-flow regulator, this project would provide all manner of downstream provincial and inter-provincial benefits. Domestic supplies, irrigation and industry are dependent on the waters of the Oldman River.

It is proposed that once the final report is received from the P.F.R.A., assuming it is favorable, consideration be given to an early start on the construction of this project. It should be possible to accomplish this within the next two to three years. It is also conceivable that federal participation in this project might be negotiated.

Clearwater River Dam

The Clearwater River is a tributary to the North Saskatchewan River. Its headwaters however are strategically located such that a minimum effort is required to divert waters from the Clearwater into the headwaters of the Red Deer River system.

Two dam sites for the control and storage of the Clearwater River have been under periodic study for some time. The results of these studies indicate that there is justification in embarking on detailed

investigation aimed at construction of at least one of the dams in the very near future.

Because of its strategic location this project would provide the dual benefit of augmenting streamflow control on the North Saskatchewan River, enhancing any future development on this system, as well as providing similar benefits to the Red Deer River system. It is practically a must if the William Pearce Project were ever to materialize.

Final studies were hopefully programmed to be undertaken during the current year, however, shortage of personnel prevented this being accomplished.

There is also a possible diversion of the Ram River into the Clearwater system which is currently under study and could eventually be beneficially utilized for firming up flows for the Clearwater project.

It is proposed that these studies continue to completion within the next two years.

Pembina River Dam

The Pembina-Paddle Rivers flood problem is one that has been brought to our attention with considerable emphasis over the past number of years. Continuing work has been underway for some time on flood control measures for the Pembina River, which is essential before any real measure of relief can be considered for the Paddle River area.

However, the work that can be done within the flood area itself is limited in its effectiveness in that, during certain years, the works will be completely incapable of preventing flooding to some degree.

In considering the most desirable remedial action, attention is being given to control of flows in the upper reaches of the Pembina and Paddle Rivers. The possibility of storage on the Paddle River is being studied by the P.F.R.A. at the request of Alberta. The people of the Paddle River valley have indicated willingness to consider forming a redrainage district. Final developments in this regard are awaiting a re-

port from the P.F.R.A. as to the results of their investigation in the upper portion of the watershed.

In the meantime, the Water Resources Branch have considered ways and means of exercising streamflow control on the Pembina River itself since it is evident that increased capacity in this river will be required to effectively contain the waters from the Paddle River system during peak floods such as were experienced during the spring of 1965.

For some years the possibility of constructing dams on the Pembina River in the vicinity of Entwistle has been known. This year, based on previous preliminary investigations, what appeared to be the most suitable site was selected for intensive study. This study is currently underway and so far nothing has developed to suggest the project is not feasible.

This dam would also become an integral part of the proposed interbasin diversion from the McLeod River to the North Saskatchewan system. It could be used to augment flows to Isle Lake, Lac St. Anne and the Sturgeon River, as well as Lake Wabamun. Because of the readily available source of power, and the presence of adequate water, the Wabamun Lake area might be considered to be a potentially desirable industrial development region.

Assuming favorable results from the investigations, it is proposed that the Pembina River dam project be scheduled for construction in 1967.

Studies

It is proposed that current studies on the following projects be intensified to bring them to completion within the next two to five years. The results of these studies will, of course, dictate what further action is considered desirable and revised water resource development implementation programmes will have to be submitted from time to time in accordance with the findings of these studies.

William Pearce Project

Lack of personnel has resulted in complete frustration in any attempts to finalize the William Pearce project proposal. A year ago an engineer was assigned to this project with the intention of preparing a final report for early submission. However the attention of this employee had to be diverted with progressive frequency to other problems of a more immediate nature. Early in the current year this engineer left our employ for a more financially lucrative position in private practise. Consequently, with the exception of spasmodic field permeability tests undertaken when staff and equipment was available, the engineering aspects of the William Pearce project are virtually at a standstill.

A study of the economic aspects of the benefits from the project has been initiated, and an ARDA submission is under preparation with the hope that this study can be undertaken in 1966.

If adequate personnel can be acquired there should be no difficulty in finalizing a proposal on this project in 1966.

The project is feasible from an engineering point of view. Whether or not it is economically feasible is a question that prompted the initiation of an economic study. It will also have to be ascertained how the construction of this scheme is to be financed and what degree of financial and operational responsibility is to be assigned to the local level. Until these things are known, it cannot be determined whether or not the people who will be the prime beneficiaries are prepared to accept a share of responsibility in the light of anticipated benefits to them. Todate we have heard principally from organizations such as Chambers of Commerce which have for some time, actively promoted this project. The people who will be most directly affected have sat very quietly by however and listened without expressing any definite opinion as to its favorability from their point of view.

It might be mentioned that the proposed Ardley power project might have changed the complex of the William Pearce scheme in that these projects were of mutual benefit each to the other. It would appear at the present that the Ardley proposal will not become a reality, at least not in the foreseeable future.

Highwood-Stimson-Willow Creek Basin Complex

This project affords one of the better immediate opportunities for water resource development on a watershed basis. There already exists various flooding and water supply problems in the area that would derive benefit from this project. Engineering studies have been actively underway for the past year and the Chain Lakes dam on Willow Creek, under construction by the P.F.R.A. at the request of Alberta, is nearing completion. It is anticipated that a staged construction programme can be ready for initiation in 1967. A study to determine the economic evaluation of the benefits from this scheme is currently being prepared for an ARDA submission. This project could be undertaken over a period of five to ten years and would be very effective in providing multi-purpose benefits to a very large area of the province.

Battle River-Red Deer Lake-Ferintosh Lake Development

Preliminary studies are underway jointly with the P.F.R.A. into enhanced utilization of the waters of the Battle River and Meeting Creek. This is a project on which close correlation should be established between the development of water and other resources of the area. At the moment there is some difficulty in establishing adequate participation at the local level, although a certain segment of the populace are enthusiastically in favor of this scheme. It is a project that may

reach a degree of maturity to warrant implementation in about 1970. Intensification of interest at the local level may require an acceleration of this programme however.

Athabasca River

Studies are currently being conducted on the Athabasca River watershed to evaluate potential storage sites which will effectively afford stream regulation benefits, principally with regard to the proposed pulp mill and consequent water pollution possibilities.

The dam site at Fort Assiniboine has been studied sufficiently to indicate that foundation conditions are unsuitable. Attention has now been directed to other sites on the tributaries to the main river. Sites on the McLeod River and the Berland River have been singled out for intensive investigation, however, before embarking on this a final review is being made of all possible sites in the Athabasca watershed. Feasibility studies are expected to be completed by the end of 1966, and developments thereafter will be dependent on the circumstances which prevail at that time.

Jumpingpound Watershed Development

Investigations have been carried out periodically into the feasibility of watershed development in the Jumpingpound area. Conservation and recreational opportunities are evident in this region and these investigations will probably reach final stages sometimes shortly after 1970.

Northern Alberta Development

Apart from major projects such as the East-West Prairie Rivers scheme, there exists on our books today drainage and land development proposals in various stages of progress amounting to some $500,000.00. A programme for accommodating the continued construction of these works is currently being formulated with the Northern Alberta Development Council. In addition to this, procedures have been established between the Department of Lands and Forests, the Department of Highways and Water Resources for a systematic development of new lands for settlement purposes. The scheduling of this programme is dictated by the decision of Cabinet that 90,000 acres of new land are to be opened for settlement each year.

A formidable amount of work is seen if our commitments and responsibilities in this area are to be satisfactorily discharged. Efforts are being concentrated toward undertaking this work through a planned watershed basin development programme.

It is anticipated that the workload in this region of activity will continue to grow at a steady rate in future years.

Research

To effectively programme and plan watershed development, the planner must have the benefit of basic and applied research. Some work has been initiated in this respect by the Water Resources Branch under the International Hydrologic Decade with support from ARDA.

Recognizing the great amount of study that has been done in the United States on both basic and applied research in the field of watershed development and management, it is suggested that we would be most

to avail ourselves of the opportunity to use this great wealth of information which our American neighbours have always enthusiastically placed at our disposal. The cost of sending Alberta representatives to observe the work and results of research being conducted at some of the research centres would be infinetesimal in comparison with that of efforts of our own to accomplish the same ends through duplication of what has already been done. If a policy of this nature was adopted it is anticipated that basic research conducted by ourselves would be a minor aspect of a development programme. Some applied research may be required in order to adopt the information derived from research elsewhere to the particular local circumstances of any area in Alberta. This work should be guided by complete evaluation of all information available on projects of a similar nature.

By virtue of the time during which the United States has already been involved in water programmes, the information available is well advanced. It is strongly doubted that the availability of technical data from the United States will ever lag behind its application to our provincial resource development programme.

Cost Estimates

It is difficult to prepare complete cost estimates for a water development programme until such time as the estimate of construction costs for each individual project has been completed. It is, however, within the realm of reasonable guesswork to propose a basic workload expenditure estimate for an expanding programme of water resource development, excluding construction costs of the major projects. This has been indicated on the attached Appendix I, which suggests that there will be a steady increase in annual expenditure until the amount

of about four and one-half million is reached in 1972. To this should be added major project construction costs as they may occur during that interval. If by 1972 several of these projects are in the process of being built, the total cost might approach seven million.

As previously mentioned, it is hopeful that by 1972, it will be possible to establish a fairly consistent year to year workload and a correspondingly consistent expenditure of monies.

The Immediate Problem

It is distressing not to be in a position to more adequately outline a definite schedule of staged development on some of our water resource projects presently under consideration. Two years ago it would have been considered possible to do so at this time, however, the depletion of staff personnel together with an ever increasing workload in every aspect of endeavour, has made it physically impossible to maintain the degree of progress originally contemplated. Our present staff is so burdened with general day to day routine business that little if any opportunity exists to apply our attention to the greater issues, namely constructive planning and preparation for future development of our water resources.

It must therefore be emphasized that the proposals and timing as outlined above are entirely dependent on the obtaining of the necessary qualified staff to undertake the work proposed. This in turn is dependent on approval of monies in the appropriations for this staff, and the success which we might have in being able to offer sufficient attraction to prospective employees to join our organization.

A recent advertisement appeared in the newspaper in which the P.F.R.A. were offering opportunities to engineers in the field of hydraulics, water development and hydrology, with salaries up to $9100.00 per year.

This is as much or more as is being paid to some of our present staff employees whom we look upon as being senior experienced personnel. Unless we are able to offer equally attractive and competitive remuneration as that being offered by federal and private agencies, we cannot hope to accomplish but a mere token of the proposal outlined in this preparation.

Conclusions

Large scale projects are often initiated as a result of imposed pressures and demands which make it imperative to take action for the protection of jurisdictional rights and interests. We are well aware of the growing interest in the use of inter-provincial waters among the priairie provinces, and we are reasonably convinced that we have just begun to see ever increasing demands imposed upon us from the United States as a result of their national water crisis. While attending a recent conference in Montana it was evident that the United States are proceeding with studies on the NAWAPA scheme in a manner that would suggest to the uninformed, that Canada had already committed itself to acceptance of this proposal.

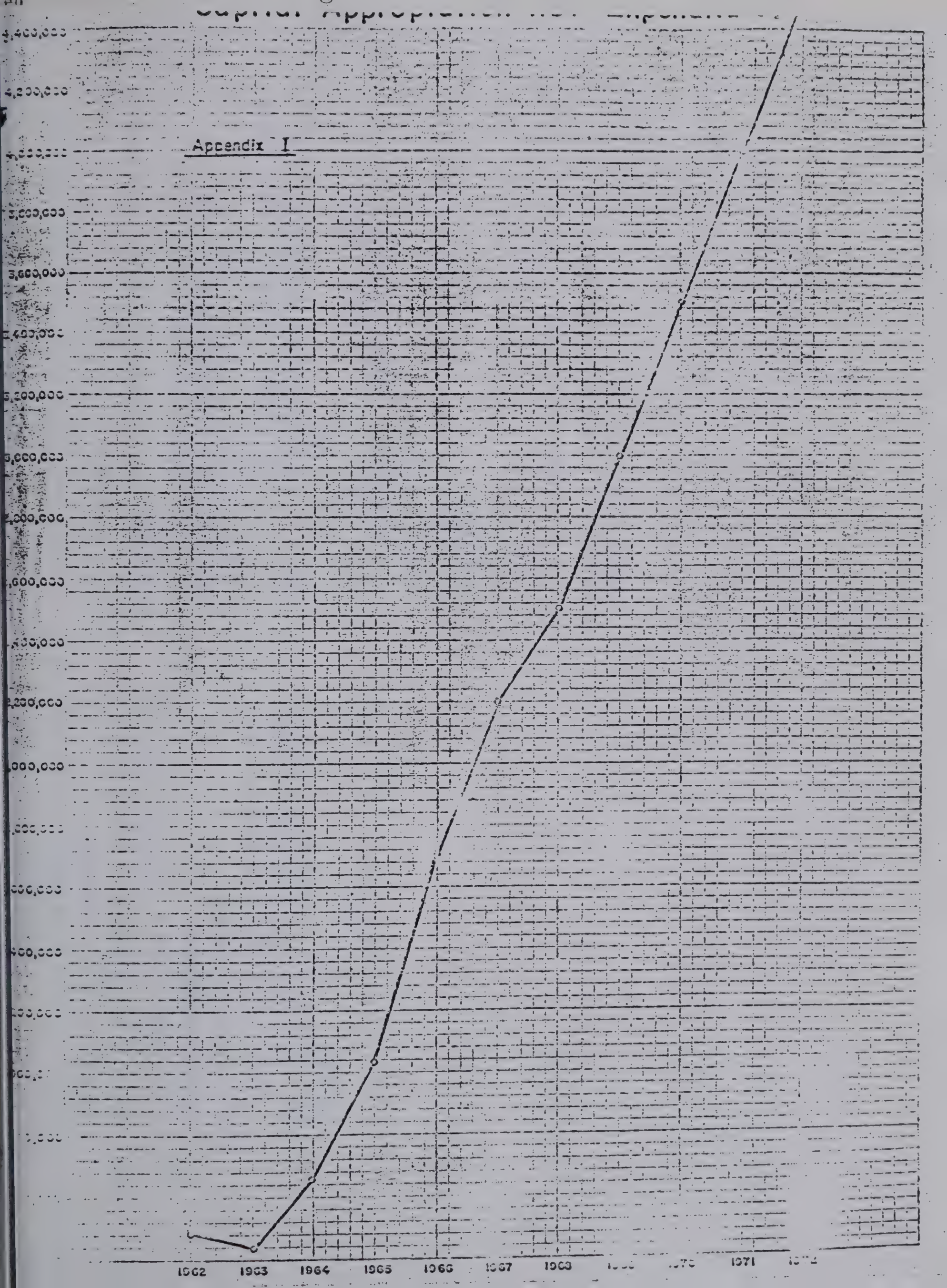
There is however one aspect of a water resource development programme, regardless of any existing or impending encroachment by outside interests, which inclines one to view expenditures for this type of programme as an investment which will provide guaranteed future economic stability and financial returns. Consider the various countries of the world that have been labeled as 'under developed', and the tremendous amount of money and aid that is being extended to these countries through the various international plans and the world bank, for purposes of developing water resources. Once these projects have been completed, the the country will have a heavy indebtedness to repay from the proceeds of the development before these proceeds can be considered as a direct benefit to the country itself.

Here in Alberta we are in the fortunate and favorable situation of being financially able to undertake large scale resource development plans, and when these plans materialize, the proceeds from them will immediately become a direct useable asset to the province, rather than having to be assigned to the retirement of an indebtedness incurred in order to carry out the development.

If countries less financially endowed feel that water resource development is important enough to be undertaken, even when such has to be financed through facilities such as the world bank, then surely similar undertakings in a province that is capable of paying its own way can only be considered as a wise and prudent investment.

Capital Appropriation and Expenditure

Appendix I



Year	Organization	Activity	Estimated Expenditures
1966-1968	Employ necessary professional and technical staff for activity programme. 4 to 6 Design & Construction Engineers. 3 to 4 Conservation & Development Engineers. 2 to 3 Hydrologists. 1 to 2 Hydrogeologists. 1 Water Resource Administration Engineer. 20 to 25 Technical and drafting personnel, plus clerical and stenographic staff as required. Establish Division of Geology and Groundwater.	1. Completion of Three Rivers Site investigations. If project feasible, initiate 5 year construction programme. 2. Completion of Clearwater River dam site investigations. 3. Completion of Pembina-Paddle Rivers studies. Final design and preparation for 3 year construction schedule for Pembina River dam. 4. Finalize William Pearce Proposal, prepare staged construction schedule if project economically feasible and commence 5 to 10 year construction programme in 1968. 5. Continue Highwood-Stimson basin investigation. Prepare 5 year staged construction schedule to commence in 1968. 6. Continue Battle River-Red Deer Lake Development studies. 7. Complete Athabasca River basin studies. 8. Continue Jumping Pound area studies. 9. Continue watershed basin development in Peace River area.	$1,700,000 to $2,500,000 per year.

Year	Organization	Activity	Estimated Expenditures
1970-1972	Complete necessary staff compliment.	1. Continue Three Rivers Dam construction. 2. Complete Clearwater Dam construction. 3. Complete Pembina River & Paddle River dams, and river channel improvement. 4. Continue William Pearce construction. 5. Continue Highwood-Stimson Basin construction. 6. Initiate construction of works on Battle River-Red Deer Lake development. 7. Continue construction Athabasca River projects. 8. Consider initiation of Jumping Pound Development. 9. Continue watershed development and construction in Peace River area. 10. Complete watershed development plans on 1 to 2 major watershed. 11. Intensify planning on third and fourth major watershed basin development.	3,500,000 to 4,500,000 per year plus 1. Provincial share of 2/5 total of Three Rivers dam. 2. 1/3 total cost of Clearwater dam. 3. 1/3 total cost of Pembina River dam. 4. Cost of 2 years construction on William Pearce project. 5. 2/5 total cost - Highwood-Stimson project. 6. 1 year construction cost - Battle River-Red Deer Lake project 7. 2/5 construction costs of Athabasca River project.

Year	Organization	Activity	Estimated Expenditures
1968-1970	Continue expansion of staff compliment as necessary to accommodate work programme. Establish full operation of soils and engineering materials laboratory.	1. Continue Three Rivers Dam construction. 2. Commence 3 year construction of Clearwater River Dam. 3. Continue Pembina River Dam construction. Begin construction of Paddle River dams and river channel improvements. 4. Continue construction of William Pearce project. 5. Undertake Highwood-Stimson basin development construction. 6. Complete Battle River-Red Deer Lake Development proposal. 7. Commence construction of Athabasca Basin works if feasible and required. 8. Complete Jumping Pound area studies. 9. Continue watershed development and construction of associated works in Peace River area. 10. Intensify planning of watershed basin development on 1 to 2 major watersheds.	$2,500,000 to $3,500,000 per year Plus 1. Provincial share of 2/5 total cost of Three Rivers dam. 2. 2/3 total cost - Clearwater Dam. 3. 2/3 total cost - Pembina River dam.. 4. Cost of Paddle River dams, 5. Cost of 2 years construction - William Pearce project. 6. 2/5 total cost - Highwood-Stimson basin development.

Year	Organization	Activity	Estimated Expenditures
1972-1980	Prepare and establish a continuing uniform development programme according to completed watershed development plans.	1. Complete Three Rivers Dam. 2. Complete Clearwater River diversion complex. 3. Continue construction of William Pearce project. 4. Complete Highwood-Stimson Basin construction. 5. Continue Battle River-Red Deer Lake project construction. 6. Complete Athabasca River project construction. 7. Undertake Jumping Pound Development if desirable. 8. Continue watershed development and construction in Peace River area. 9. Programme continuing watershed development planning on remaining major watersheds. 10. Initiate construction as indicated by completed watershed development master plans.	$4,500,000 per year plus 1. Balance of Three Rivers dam construction costs. 2. Annual cost of construction & development - William Pearce project. 3. Balance of construction costs on Highwood-Stimson project. 4. Balance of cost on Battle River-Red Deer lake development. 5. Balance of costs on Athabasca River project. 6. Cost of newly initiated construction & development in accordance with watershed development plans.

Year	Organization	Activity	Estimated Expenditures
1975-1990	Prepare and establish a continuing uniform development program according to completed watershed development plans.	1. Complete Three Rivers Dam. 2. Complete Clearwater River diversion canals. 3. Continue construction of Willian Tracts project. 4. Complete Highwood-Stinson Basin construction. 5. Continue Devils River-Red Deer Lake project construction. 6. Complete Riverbend Dam project construction. 7. Undertake planning flood protection at Beaver River confluence. 8. Continue watershed development and construction in Deep River area. 9. Programme continuing watershed development planning for remaining major rivers. 10. Initiate reforestation on lands cut by completed watershed development major plans.	$4,500,000 per year plus A. Balance of Three Rivers dam construction costs. B. Annual cost of continuing development - Willian Tracts project. C. Balance of construction costs on Highwood-Stinson project. D. Balance of construction costs on Devils River-Red Deer Lake project. E. Balance of construction costs on Riverbend Dam project. F. Balance of construction costs on Beaver River confluence flood protection. G. Costs of newly initiated reforestation & development in accordance with watershed development plans.